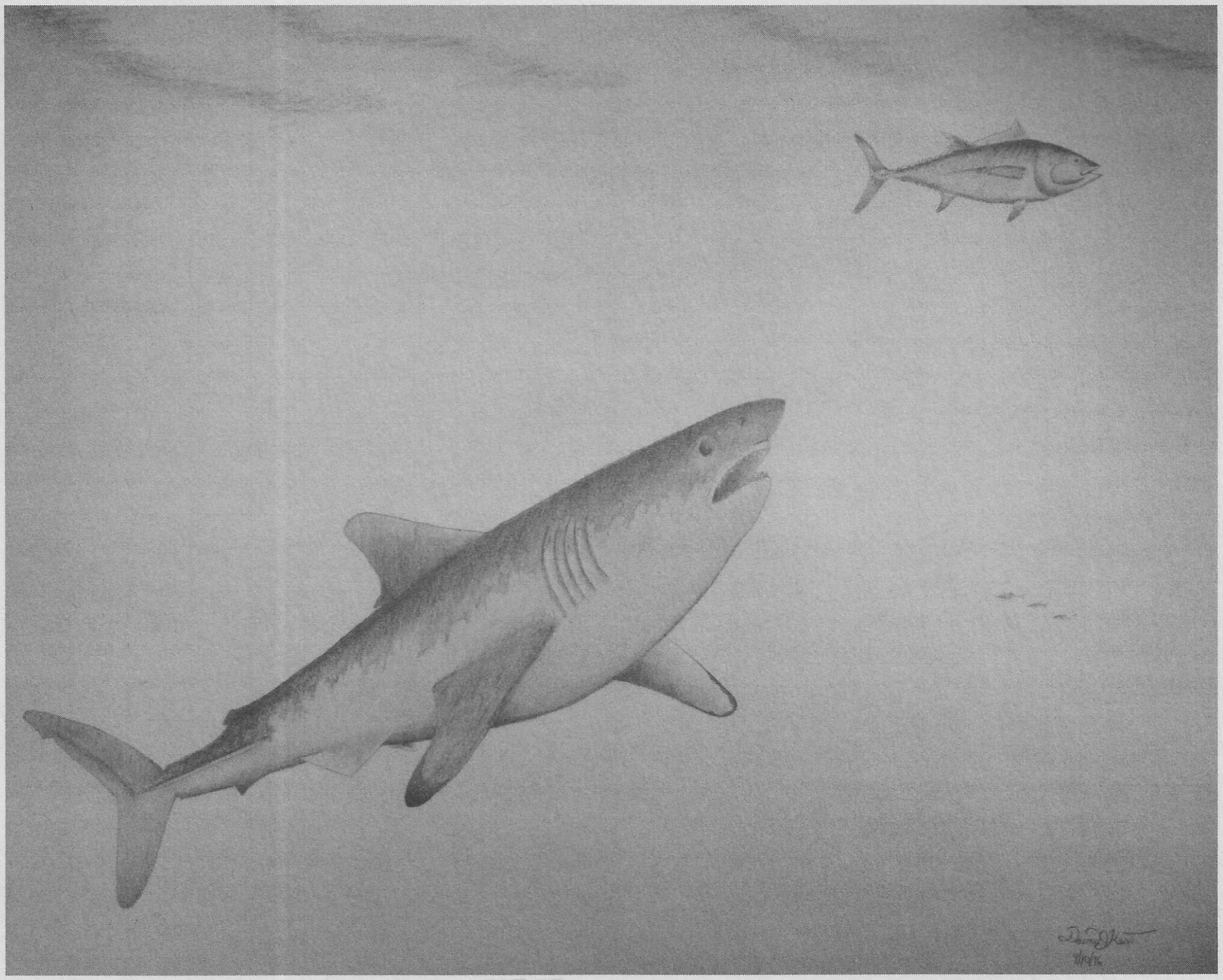
# THE MOSASAUR



# THE JOURNAL OF THE DELAWARE VALLEY PALEONTOLOGICAL SOCIETY

VOLUME VI MAY, 1999

# A Late Cretaceous (Severn Formation) Vertebrate Assemblage from Bowie, Maryland

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ABSTRACT — A stream bank near the town of Bowie, Prince Georges County, Maryland, exposes a richly fossiliferous section of Late Cretaceous, Severn Formation vertebrate material. This paper presents a brief description of the site and identifies the common and rare types of vertebrate specimens found, which include chondrichthyans, fishes, and reptiles.

## Introduction

A fossiliferous stream bank outcrop (Coordinates 76°42'30"/38°57'50") exposing the Severn Formation, near the town of Bowie, Prince Georges County, Maryland, was reported by Glaser (1986). It was investigated by the authors and other collectors on numerous occasions over the last decade. A comprehensive literature search in several geological and paleontological databases failed to reveal any reference sources which provided a detailed account of the fossils found at the site. The purpose of this paper is to report on the site and further document the extensive vertebrate faunal assemblage. We seek to present an extensive listing of the vertebrate material found, including three Cretaceous species not previously reported in Maryland, the neoselachians *Ptychotrygon vermiculata*, *Ischyrhiza avonicola* and *Rhinobatos casieri*. A brief discussion of the depositional environment is also included.

## Geology

The Severn Formation is marine and dated as early Maastrichtian (Late Cretaceous) in age, corresponding to the Navarroan Provincial stage (Browers and Hazel, 1978). The fossiliferous Severn layer at this site is exposed in a thin bed of compact pale-gray sand just above the stream level. The sand contains numerous small, black, phosphatic grains as well as larger phosphate pebbles. The most concentrated layer of fossils, mostly sharks' teeth, is at the top of the sand lens where it grades into the dark color of the Severn Fm. above. The sand layer also contains scattered quartz pebbles and large siderite concretions. The layer overlies a dark-gray dense micaceous silty clay which is the top of the Matawan Formation (Glaser, 1986).

The site appears to be a transgressive lag deposit with a very diverse fauna with shallow and open marine, fluvial, and terrestrial representatives. Based on observations, the outcrop represents a low spot or shallow trough in the underlying Matawan Formation. The sand lens is localized and is not present everywhere at the contact between the Severn and Matawan. Fossils are plentiful but are typically very worn. This indicates a very high energy environment, with the likelihood that the highly worn fossils are reworked. The presence of some fossils, especially larger bones, that show little evidence of rework or wear, indicates rapid burial.

## Field Techniques

Fossiliferous material was collected by digging chunks of sand from the outcrop and washing them on 1/8 inch hardware cloth. This material was then placed in buckets, brought back to the authors' workshops, placed on 1/16 inch window screen, rinsed, dried, and then examined. In addition, surface collecting was conducted by looking for fossils in situ, on the stream banks, and in the stream, itself. Material collected from the site, and reported in this paper, is somewhat size-biased due to the screen sizes used and the visual skills of the authors.

## Paleontology

The material collected was a vertebrate scrap fauna, typical of the Severn Formation (See Hartstein and Decina, 1986; Baird, 1986; Weishampel and Young, 1996). Chondrichthian remains comprised the majority of specimens collected. Osteichthian remains and those of marine reptiles were also common. Several pieces of dinosaur material were also found. This paper does not focus on the invertebrate material collected, but common forms represented the classes Pelecypoda, Gastropoda, and Anthozoa.

Over 90 percent of the shark teeth collected were from three species, *Carcharias samhammeri*, *Squalicorax kaupi*, and *Serratolamna serrata*. Over a dozen less common shark species were also identified. The hybodont shark, *Hybodus*, was represented by a single cephalic hook. Over 90 percent of the ray teeth and dentition fragments represented the genus *Rhombodus*. In addition isolated pavement bars from *Myliobatis sp.* were not uncommon. Cappetta (1987) does not show *Myliobatis*' range extending back into the Cretaceous. Hartstein & Decina (1986) indicated that *Myliobatis sp.* teeth were found at the Landover Rd. construction site in Prince Georges County, Md. Unlike the Bowie teeth, the Landover Rd. teeth were not found in-situ and could have come from the Brightseat Fm. (Paleocene). Since then several authors (eg. Welton & Farrish, 1994) have indicated that "*Myliobatis* like" teeth have been collected in the Cretaceous, however none to our knowledge have stated that these are *Myliobatis* teeth. The shark and ray fauna shows remarkable affinities to that described by Case and Cappetta (1997), showing that many of the species were far ranging, occurring both in Texas and eastern Maryland.

While most of the chondrichthyan remains collected belong

in the subclass Elasmobranchii, several holocephalian fossils, pieces of *Ischyodus sp.* (ratfish) jaw, were collected. Over 95 percent of all the bony fish teeth collected, came from the genus *Enchodus*. Also common were isolated crushing teeth of *Parabula*. In addition to the identified teeth, numerous vertebrae of sharks, rays and fishes as well as batioid scales and other scraps of sharks and fishes, that were either not diagnostic or not identified, were found.

Remains of marine reptiles including turtles, crocodiles, mosasaurs, and plesiosaurs were also present in the material collected. At least two genera of turtles were present, *Trionyx* and *Peritresius* as identified by distinctively patterned carapace fragments and a *Trionyx* claw core. According to Baird (1986) trionychid remains from the Cretaceous of the Atlantic Coastal Plain are assigned to either *Trionyx priscus* or *T. halophilus* by convention, although the material collected is not sufficiently diagnostic and complete to establish that they belong to the genus *Trionyx, sensu stricto*. We followed Baird's convention of assigning Severn Fm. trionychids to *T. priscus*. Several turtle pieces of unknown affinity including vertebrae and a lower jaw fragment were also collected. There were at least 3 species of crocodilians represented. Most common were distinctive teeth from *Thoracosaurus*. Other crocodile species represented from scutes and teeth included a small alligatorine (similar to *Allognathosuchus*) and *Deinosuchus rugosus*. The possibility of other crocodilians exists, however "isolated teeth of most crocodilians do not possess sufficient diagnostic characters for low level taxonomic assignment because of high species variability and general similarity within the group" (Westgate, 1989). The determination of *Deinosuchus* was made on the basis of one large, inflated rear tooth that could not have belonged either to *Thoracosaurus* or the small alligatorine. In addition a number of button like crocodilian teeth were found. These may belong to *Bottosaurus harlani* Several unidentified crocodilian vertebrae were also found. Mosasaur tooth fragments were not uncommon, but complete teeth were fairly rare. At least one genus, *Mosasaurus* was indicated by the typical faceted teeth. Plesiosaur remains are rare and based on only two teeth and one vertebra. The specimens are very similar to *Cimoliasaurus magnus*, which was identified at another Severn site in Maryland (Baird, 1986). Two hadrosaurine teeth and an ornithomimid toe bone have been recovered. Dinosaur fossils have previously been reported in the Severn (Weishampel and Young, 1996).

Table 1 lists the vertebrate fauna identified from the site using the field collection techniques mentioned in this paper. Plates 1, 2, and 3 illustrate some of the more interesting specimens collected.

**Table 1.** Faunal List

Chondrichthyes

*Carcharias holmdelensis* (Cappetta & Case)
*Carcharias samhammeri* (Cappetta & Case)
*Chiloscyllium greeni* (Cappetta)
*Cretolamna appendiculata* (Agassiz)
*Dasyatis sp.* - (Genus *Dasyatis*, Rafinesque)
*Ewingia problematica* Case & Cappetta
*Galeorhinus giradoti* Herman
*Ginglymostoma sp.* - (Genus *Ginglymostoma*, Muller & Henle)
*Heterodontus sp.* - (Genus *Heterodontus* , Blainville)
*Hybodus sp.* - (Genus *Hybodus*, Agassiz)
*Ischyrhiza cf. avonicola* Estes
*Ischyrhiza mira mira* Leidy
*Myliobatis sp.* - (Genus *Myliobatis*, Cuvier)
*Odontaspis aculeatus* (Cappetta & Case)
*Plicatoscyllium antiquum* Case & Cappetta
*Plicatoscyllium derameei* Case & Cappetta
*Pseudohypolophus mcnultyi* Thurmond
*Ptychotrygon vermiculata* Cappetta
*Raja farishi* Case & Cappetta
*Rhinobatos sp.* - (Genus *Rhinobatos*, Linck)
*Rhombodus binkhorsti* Dames
*Serratolamna serrata* (Agassiz)
*Squalicorax kaupi* (Agassiz)
*Squalicorax pristodontus* (Agassiz)
*Squatina hassei* Leriche
*Ischyodus sp.* - (Genus *Ischyodus*, Egerton)

Osteichthyes

Albulidae indet.
*Anomoedus cf. phaseolus* (Hay)
*Cylindracanthus sp.* - (Genus *Cylindracanthus*, Leidy)
*Egertonia sp.*
*Enchodus ferox* Leidy
*Hadrodus sp.* - (Genus *Hadrodus*, Gregory)
*Lepisosteus sp.* - (Genus *Lepisosteus*, Lacepede)
*Paralbula casei* Estes

Reptilia

(Order Chelonia)
*Peritresius ornatus* (Leidy)
*Trionyx priscus* Leidy

(Order Crocodylia)
*Bottosaurus harlani* (Meyer)
Alligatorine, similar to *Allognathosuchus* - (Genus *Allognathosuchus*, Mook)
*Thoracosaurus neocesariensis* (DeKay)
*Deinosuchus rugosus* (Emmons)

(Order Squamata)
*Mosasaurus sp.* - (Genus *Mosasaurus*, Conybeare)
(Order Plesiosauria)
*Cimoliasaurus magnus* Leidy

(Order Ornithischia)
Hadrosaurid teeth

(Order Saurischia)
Ornithomimid toe bone

## Discussion

Identification of some of the fossils has been complicated by the generally worn condition of this scrap fauna. Often key identifying features such as striations or root morphology were not observable due to the wear. This problem became particularly serious in trying to separate small orectolobid and batioid teeth. In addition many teeth, particularly the reptiles, are not sufficiently diagnostic to identify species and sometimes even genus. This is particularly true of the alligatorine teeth and the mosasaur teeth, where general morphology varies greatly with the position in the mouth. Nonetheless there appears to be a diverse reptile fauna. Anomalously some of the fossils that one would expect to be most worn were not. For instance, since the Severn Fm. is marine, the ornithomimid toe bone had to have been washed into the sediment from the land. Yet, it showed very little evidence of wear, far less than the shark teeth and other marine fossils in the same layer. Similar low wear was noted on the large *Thoracosaurus* scute and on the *Cimoliasaurus* vertebra. This suggests that the fossils may have had different taphonomic histories. It is the authors' intent to document the fauna at this site as unambiguously as possible. The authors do not intend this paper to be a revision to taxonomy. Therefore, for clarity and simplicity, we have followed the conventions established by well known authors as follows. All sharks follow Case and Cappetta (1997) first, Kent (1994) second and Cappetta (1987) third. All remaining fauna follow Carroll (1988).

## Acknowledgments

The authors wish to thank several individuals in their help in identifying and reviewing specimens. First, a special thanks to Earl Manning and Dave Parris, both of whom examined many of the specimens and offered helpful suggestions, especially with identification of the crocodile, mosasaur and fish material. Second, thanks go to Robert Wiest, Ned Gilmore, George Fonger, and Edward Lauginiger for comments and suggestions. Thanks are also expressed to other dedicated amateurs who loaned us specimens for the plates, Mike Folmer, Mike McCloskey, Ed Lauginiger and Pat Gotsis.

A special thanks goes to Gerard Case for reviewing the paper and giving us a copy of his March, 1997 paper on the Selachians from the Late Maastrrichtian of Texas.

Final thanks go to Gaye "Ratfish" Williams who helped us maintain permission to collect at the site and Richard Steer who represented the Institute for Defense Analyses, the owner of the property.

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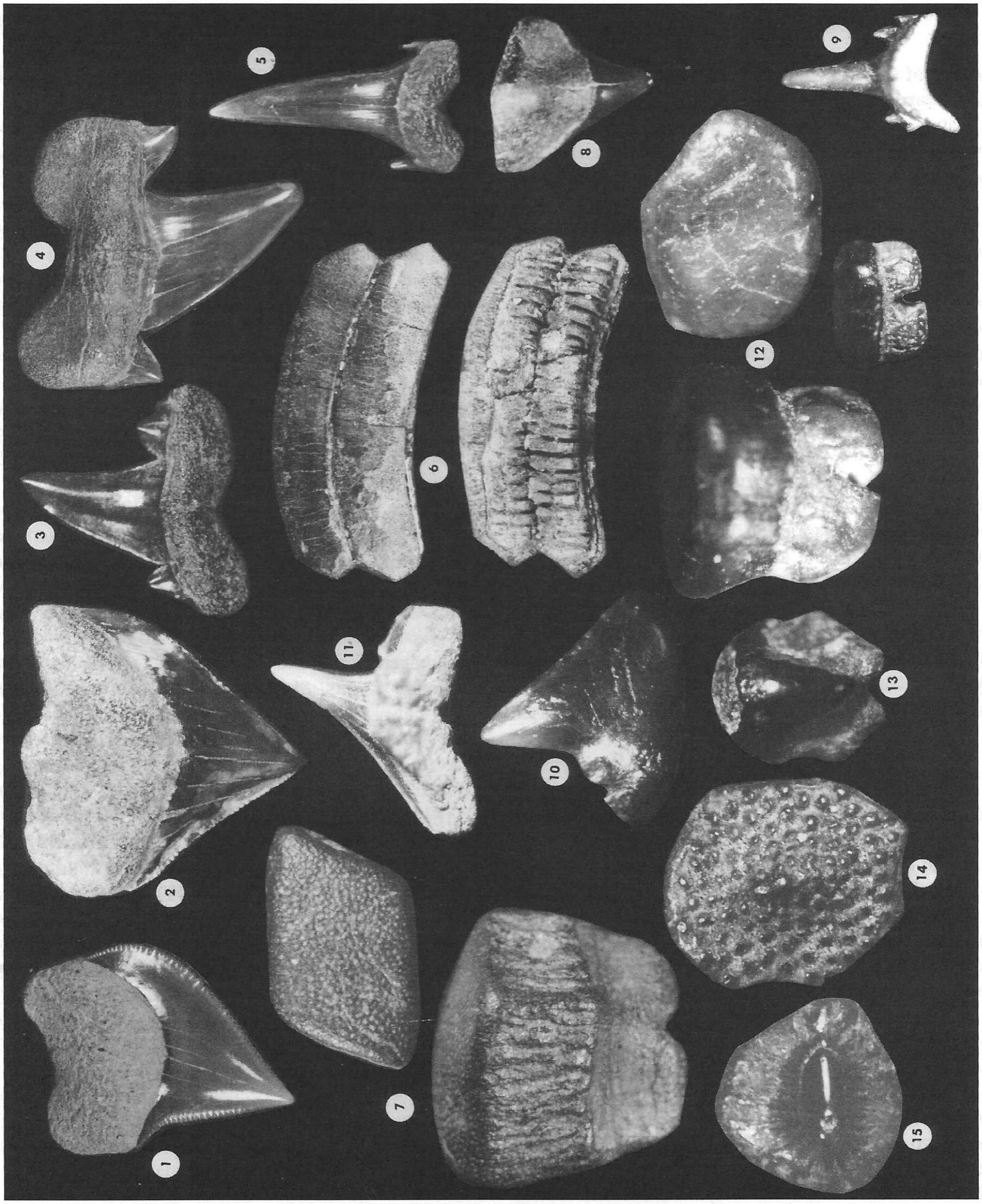

**Plate 1.** 1) ***Squalicorax kaupi***, lingual view, 15 mm height; 2) ***Squalicorax pristodontus***, lingual view, 30 mm height; 3) ***Serratolamna serrata***, lingual view, 14 mm height; 4) ***Cretolamna appendiculata***, lingual view, 34 mm slant height; 5) ***Carcharias holmdelensis***, lingual view, 16 mm height; 6) ***Myliobatis sp***., occlusal and basal views of two attached bars, 37 mm long x 17 mm wide x 11 mm deep at center; 7) ***Rhombodus binkhorsti,*** occlusal and lateral views , 5 mm long x 9 mm wide x 13 mm height; 8) ***Squatina hassei,*** lingual view, 6 mm height; 9) ***Odontaspis aculeatus,*** lingual view, 6 mm height; 10) ***Galeorhinus giradoti,*** labial view, 4 mm height; 11) ***Galeorhinus giradoti,*** lingual view - different tooth, 3 mm height; 12) ***Pseudohypolophus mcnultyi,*** occlusal and lateral views, 4 mm length x 3 mm height. X 4 mm wide; 13) ***Rhinobatos sp.,*** occlusal view, 2 mm height; 14) Batoid scute, 13 mm long x 11 mm wide x 5 mm height; 15) Batoid scute type II, ~ 7 mm diameter

**Plate 2.** 16) ***Plicatoscyllium derameei***, labial view, 9 mm height; 17) ***Plicatoscyllium derameei,*** labial view, 6 mm height; 18) ***Ginglymostoma sp.***, labial view, 6 mm ht height; 19) ***Ginglymostoma sp.,*** labial view, 6 mm width, (McCloskey collection); 20) ***Plicatoscyllium antiquum***, labial view, 3 mm height; 21) ***Ginglymostoma sp.***, labial view, 3 mm height; 22) ***Ischyodus sp.,*** jaw section, 18 mm long. (Hartstein collection); 23) ***Squatina hassei***, labial view 7 mm wide x 6 mm height; 24) ***Squatina hassei***, same tooth basal view, 4 mm x 7 mm; 25) ***Dasyatis sp.***, lingual view, 2 mm x 1.5 mm (Keil collection); 26) ***Dasyatis sp***., same tooth basal view, 2 mm x 1.5 mm; 27) ***Dasyatis sp***, same tooth occlusal view, 2 mm x 1.5 mm; 28) ***Raja farishi.***, lateral view, 2 mm height (Keil collection); 29) ***Raja farishi,*** occlusal view, 2 mm height; 30) ***Ischyrhiza cf. avonicola***, lateral view of rostral spine, 3 mm height (Keil collection); 31) ***Ptychotrygon vermiculata,*** basal and occlusal views, 5 mm x 3 mm; 32) ***Plicatoscyllium antiquum,*** labial view, 6 mm height; 33) ***Heterodontus sp***., occlusal view, 5 mm x 2.5 mm; 34) ***Ewingia problematica***, lateral view of rostral spine, 3 mm height; 35) ***Ischyrhiza mira,*** base of rostral spine, 26 mm x 16 mm; 36) ***Carcharias samhammeri,*** lingual view, 16 mm height


**Plate 3.** 37) ***Cylindracanthus sp.***, 35 mm long x 4 mm diameter; 38) ***Anomoedus cf. phaseolus***, occlusal view 18 mm long x 6 mm wide (Decina collection); 39) ***Anomoedus cf. phaseolus***, basal view of same tooth; 40) ***Lepisosteus sp***, gar scale 7 mm long; 41) ***Hadrodus sp.***, 10 mm maximum length (Decina collection); 42) ***Echodus ferox***, 44 mm length; 43) ***Echodus ferox***, 15 mm length; 44) ***Echodus ferox***, jaw section. 33 mm long; 45) ***Echodus ferox***, 13 mm length; 46) ***Egertonia sp.***, occlusal surface, 6 mm diameter; 47) Albulidae indet., oclusal and basal views, 2mm diameter x 2 mm height; 48) ***Paralbula casei***, occlusal surface of worn jaw section, 6.5 mm maximum length; 49) Unidentified bony fish vertebra. 10 mm average diameter; 50) Steinkern of snail.10 mm long; 51) Alligatorine tooth, 5 mm height x 6 mm wide; 52) Alligatorine tooth, 4 mm height x 3 mm wide; 53) Alligatorine tooth, 7 mm height x 4.5 mm wide; 54) Turtle claw core, 15 mm long x 6 mm wide (Keil collection)

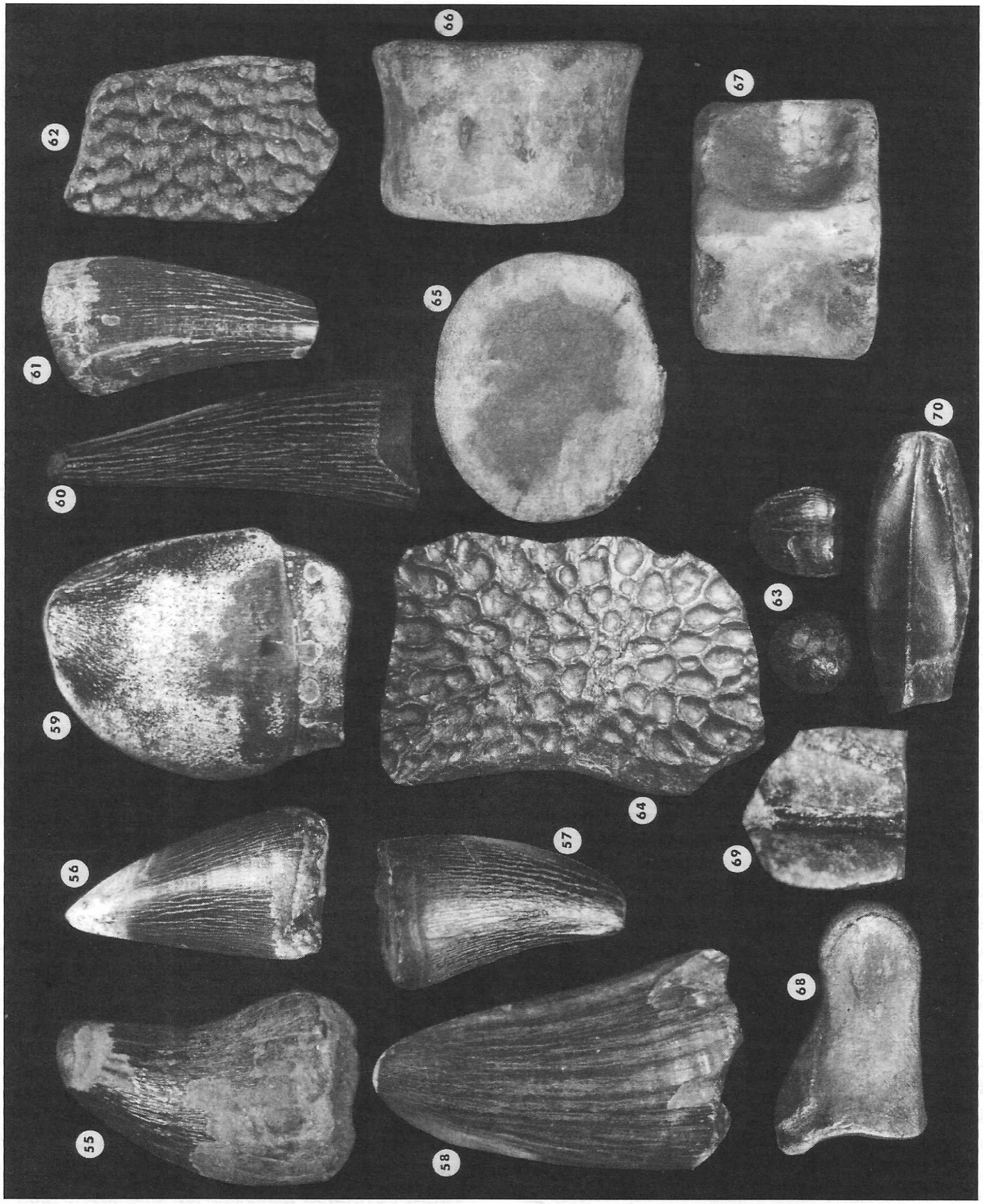


**Plate 4.** 55) ***Mosasaurus sp.***, 26 mm height x 11 mm wide; 56) ***Mosasaurus sp,*** 23 mm height x 13 mm wide; 57) ***Mosasaurus sp,*** 25 mm height x 16 mm wide (Folmer collection); 58) ***Mosasaurus sp,*** possibly ***Mosasaurus maximus*** 29 height x 20 mm wide; 59) ***Deinosuchus rugosus,*** rear tooth, 29 mm height x 22 mm deep x 19 mm wide (Gotsis collection); 60) ***Cimoliasaurus magnus,*** 31 mm long x 13 mm diameter @ base (Folmer collection); 61) ***Thoracosaurus neocesariensis,*** 27 mm height x 11 mm x 9 mm @ base (Decina collection); 62) ***Trionyx priscus***, carapace fragment, 25 mm height x 15 mm wide; 63) Alligatorine tooth, 5 mm height x 5 mm wide; 64) ***Thoracosaurus neocesariensis,*** scute 125 mm height x 87 mm wide (McCloskey collection); 65) ***Cimoliasaurus magnus,*** vertebra, face 73mm x 84mm, height 58mm (Lauginiger collection); 66) ***Cimoliasaurus magnus,*** same vertebra; 67) ***Cimoliasaurus magnus,*** same vertebra; 68) Ornithomimid toe bone, 56 mm long x 36 mm height @ proximal end (Folmer collection); 69) Hadrosaurid tooth, 9 mm high x 9 mm deep x 7 mm wide (Decina collection); 70) Hadrosaurid tooth, 25 mm long x 14 mm deep x 12 mm wide (cast of original from Weist collection)